Ecosystem Whitepaper

FinBook Pte. Ltd. (token@finbook.co)

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Introduction

The rapid proliferation of cryptocurrencies such as Bitcoin has brought world's attention to a fascinating idea by economist Friedrich von Hayek: competing private currencies.

In the Nobel laureate's 1976 book, *Denationalization of Money*, Hayek argues that there is no innate reason for governments to have a monopoly on money. He advocates a system of private currencies in which financial institutions and individuals create currencies that compete for acceptance. Hayek also points out that stability in value is presumed to be the decisive factor for acceptance.

Cryptocurrencies, thanks to their innovative solutions to decentralization and privacy, have become popular contenders in the private currency competition. However, major cryptocurrencies are subject to massive price volatility, making them attractive to speculators but unsuitable for mainstream use.

Inspired by the trilemma in international economics, we hereby propose the impossible trinity of cryptocurrencies: a blockchain economy cannot achieve all three of below goals at the same time. In pursuing any two of these goals, the community must forgo the third.

a) A deterministic currency supply

b) hypergrowth in ecosystem activities

c) price-stability of the underlying currency

Majority of blockchain economies have been experiencing the same scenario: a deterministic currency supply and hypergrowth in users & transactions. This setting results in high volatility of underlying currency price, which in turn magnifies the currency's speculation, undermines its potential as a medium of payment, and hinders its real life adoption.

Take Ethereum, the leading smart contract platform, for example. The built-in currency ether (ETH) is playing a dual role with conflicting purposes: As the network fuel and medium of exchange, ether is expected to be spent whenever users need services, which requires short-term value stability. As a digital asset, ether is held for long-term appreciation and traded for speculations.

It would be a good idea to segregate ether's dual role to better serve respective users for different purposes. Instead of creating new credits by collateralizing external assets, we propose an innovative contract that will retain ether's value but transfer volatility from risk avoiders to risk seekers.

DUO Network

Inspired by the dual-purpose fund that has gained popularity in the US and China, we designed a mechanism that converts a basic crypto asset, such as ether, into dual-class tranched tokens, providing fixed incomes and leveraged capital gains for respective class. The collective system of tokens, smart contracts and other services are named DUO Network. Please refer to https://duo.network for updates.

Below is a brief introduction of the Network's components. For complete design and analysis, please refer to our Academic Whitepaper.

Tranche Tokens

Class A Token also known as the Income Token, continuously accumulates interests based on its original net value at last Reset event. It will also receive token payments at each Reset event. It is possible to further split Token A into A' and B' or A0 and A1 tokens to reduce its volatility, based on extensions in our Academic Whitepaper.

Class B Token also known as the Leverage Token, entitles to leveraged participation of the underlying digital assets.

Smart Contract

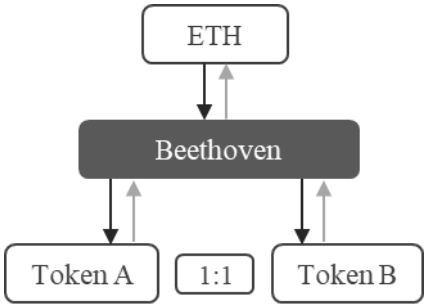
The **Beethoven** contract performs multiple tasks that facilitate key mechanism of the system, including: creation and redemption of Tranche Tokens, safekeeping the underlying digital assets (e.g. ETH), calculation of tokens' net values, and execution of reset events.

Creation and Redemption

Tranche Tokens can be created by depositing ethers to Beethoven. Upon receiving ethers, Beethoven will return to the sender equal amount of Token A and Token B.

The deposited ethers are kept by Beethoven as collateral. Any user or member of the public can verify the collateral and tokens issued through third party applications such as Etherscan.io.

Holders of Tranche Tokens can withdraw deposited ethers at any time by performing a redemption. To do this, users will send equal amount of Token A and Token B to Beethoven and receive ethers with the same net value.



Performance

Assume that the ETH price is $1,000. Depositing 1 ETH will create 500 Token A and 500 Token B. It is governed by Beethoven that Token A receives fixed annual returns (e.g. 12%). Token B will receive all ETH price returns and pay Token A's fixed returns.

Case 1: ETH/USD price rises from 1,000 to 1,200 (20% up) after 3 months

Token A receives $15 (3%); Token B receives $185; B's return is 37%.

Case 2: ETH/USD price falls from 1,000 to 900 (-10% down) after 3 months

Token A still receives $15 (3%); Token B loses $115; B's return is -23%.

Case 3: ETH/USD price remains at 1,000 (flat) after 3 months

Token A still receives $15 (3%); Token B loses $15; B's return is -3%.

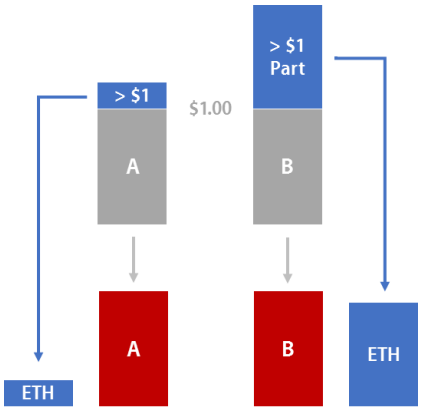
Simply put, the holders of Token B borrow capital from the holders of Token A and invest in ETH, which leads the Token B to possess a continuum of leverage ratios. When ETH/USD price rises, the leverage ratio decreases, and vice versa.

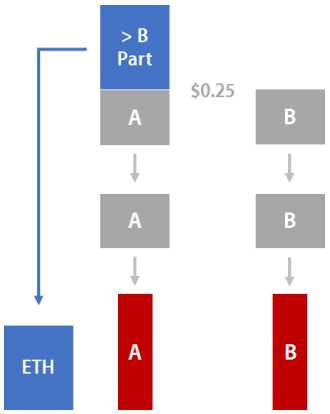
Resets

A user holds Token B to earn leveraged return. Token B will maintain certain level of leverage to remain attractive. On the other hand, an investor holds Token A to earn a fixed interest over principal. When valuation of ether increases, the value of Token B increases much faster and therefore, the implied leverage decreases. When valuation of ether decreases, the value of Token B decreases much faster and therefore, the implied leverage increases.

To reduce risk of both tranches, a set of upward and downward reset clauses is imposed.

When ETH/USD price rises to a certain level, an Upward Reset is triggered to increase Token B's leverage and reduce net value. In such case, the holders of Token B will receive a certain amount of ETH released from the smart contract.





When ETH/USD price drops to a certain level, a Downward Reset is triggered to reduce Token B's leverage and increase net value. In such case, the quantities of Token A and Token B tokens will be discounted. Then Token A holders will receive a certain amount of ETH released from the smart contract.

Please refer to the Academic Whitepaper for detailed mechanism of the Resets.

Decentralized Margin Trading/Lending

The DUO concept can be extended beyond price-stable tokens. The flexible design of the smart contract allows collateralized assets being extended from ether to any ERC-20 tokens, and the price feed from any trading pair.

For example: a DUO smart contract can be customized to accept 0x tokens (ZRX) as collateral and take a ZRX/BTC price feed. The resulting Class A Token will be pegged to BTC value, while the Class B Token will have leveraged exposure to ZRX/BTC price.

Another interesting use case could be: a DUO contract accepting ether as collateral and take an ETH/EOS price feed (it's usually quoted in EOS/ETH but a simple reversion will do the math), can provide Class A Token pegging to EOS value, and Class B Token with leveraged exposure to ETH/EOS price (or from another perspective, a bear leveraged exposure to EOS/ETH price).

All DUO Network contracts are operated entirely on Ethereum platform, taking price feeds from a carefully designed distributed oracle network. The core engineering team is going to publish an Engineering Whitepaper to explain the system design and implementation in details.

DUO Network Token

The design of the DUO Network requires a token whose value is implicitly linked to the growth and adoption of the Network. Mechanisms used to reward good behavior and promote expansion need to be tied solely to the success of the Network. A utility token owned by the DUO Network is required.

The DUO Network Token is an ERC-20 compatible token issued on Ethereum, with limited supply. It is the primary token used for DUO Network's smart contracts.

Please note: legal and regulatory policy may require changes in this token model. We aim to be as transparent as possible with the DUO Network community and will share any updates as they occur.

Conversion Arbitrage

Arbitrage opportunity appears when Tranche Tokens are traded away from their fair values. If the combined market prices of Tranche Tokens are higher than the underlying ethers' value, a trader may deposit ethers to Beethoven, and sell the created Tranche Tokens on open market for more ethers. And vice versa.

To perform above arbitrages, a trader needs to closely monitor the tokens' market prices and act in the correct direction.

Mining

The Network provides its participants with an incentive scheme similar to mining on blockchains. Instead of recording transactions on blockchain, The Network recognizes conversion arbitraging, which helps stabilizing the token prices, as the mining operation. In addition to arbitrage profits, the Network rewards participating users with DUO token. The detailed reward scheme will be released at a later stage.

Processing Fee

Beethoven charges a small percent of fees on token conversions. The operating DUO Member can choose to pay fees in ETH or DUO. At early stage, payments in DUO will enjoy a discount to encourage DUO's adoption. All DUO collected by Beethoven will be burnt until 50% of total issued DUO are left.

The conversion proceeds in ETH will be primarily used to maintain the daily operation of the Network, such as pricing feeds, oracles, gas fuels and personnel expenses. Excess of the proceeds will be reserved and used to improve the price stabilization, liquidity and market awareness of the DUO Network.

Beethoven income belongs to the DUO Network community. A dedicated non-profit legal entity will be set up to handle these digital assets.

Token Allocation

Total supply of DUO Network Tokens = 100,000,000 DUO

A - Team, Advisers, Early Investors	26%
B - For Sale	40%
C - Operation Reserve*	10%
D - Community Reserve**	24%

* Consists of partnership, team expansion and other operational expenses.

** Consists of marketing, bounty program, air-drops and mining rewards.

Network Users

Arbitragers

It is assumed that arbitragers primarily seek arbitrage profits and Network mining rewards. These users will monitor the Network's price dislocation and perform arbitrage to stabilize the token prices. Network Tokens are awarded to them according to their contributions.

Token A Holders

These are the users seeking low-volatility and income-generating digital assets. The users of Token A may include digital asset funds, service providers, ICO project teams, exchanges and risk-averse investors. The token is an ideal safe haven asset during market turmoil.

Token A's short-to-mid-term price stability makes it a good medium of exchange. Compared to other stablecoin designs, Token A does not charge extra transaction fee and steadily appreciates over time.

Token B Holders

They are normally considered as leverage players or speculators, who are optimistic on ETH's future performance and look to borrow to increase price exposure.

When ETH price drops, Token B’s leverage rises. Academic studies show that retail investors pay higher premiums for higher leverage. This implies that despite the general belief that people are risk-averse when market goes down, Token B becomes more attractive to speculators because of increased leverage. This provides additional support to Token B’s demand in a down market.

Team

Executive Team

Jerry LI - CEO

Jerry graduated from National University of Singapore (NUS) with Highest Distinction in Quantitative Finance. He worked at Citi and SS&C on hedge fund valuation, where he built the regional quantitative team, and advised multiple billion-dollar hedge funds in valuation policy and derivatives strategies. Before joining Citi, Jerry was a sales & trading analyst at UBS Investment Bank.

Yizhou CAO - CTO

Yizhou worked at Nomura Securities for forex proprietary trading and at Credit Suisse for fixed income technology. He is experienced in trading and large-scale system development. Yizhou graduated from NUS with Highest Distinction in Quantitative Finance and Statistics. His thesis formulated a comprehensive model in stochastic control framework for strategic transmission of costly information problem in a continuous time setting.

Guojie LIU

Investor Relation (part-time)

BlackRock, Cambridge University,
National University of Singapore

Weitao YANG

Blockchain & Data Engineer

Deloitte Consulting,
Nanyang Technology University

Sihao WEN

Front-end Designer/Engineer

Risewinter Technology,
National University of Singapore

Tony REN

Blockchain Architect

Accenture, Huawei,
Nanyang Technology University

Lino WANG

Marketing

ZhenFund, George Washington University

Xiaobo WENG

Financial Engineer

IHS Markit, Citi, Morgan Stanley,
London Business School,
National University of Singapore

Wenjing ZHANG

Financial Engineer

HSBC, National University of Singapore

He WANG

Software Engineer

PIMCO, National University of Singapore,
Nanyang Technology University

Academic Advisers

Steven KOU

Professor Kou is the Director of Risk Management Institute and the Class of 62 Chair Professor at the National University of Singapore (NUS). Before joining NUS, Professor Kou worked at Columbia University, University of Michigan, and Rutgers University. He is a world-renowned expert in Financial Engineering and Applied Probability. He has published in numerous journals including Management Science, Operations Research, Mathematical Finance, and received the Erlang Prize by the Applied Probability Society of INFORMS. In terms of

financial engineering, Professor Kou is well-known for his research on the double exponential jump diffusion model and models for growth stocks, which have been widely used on Wall Street. He is currently the Co-Area Editor in Financial Engineering Area of Operations Research and Associate Editor of Mathematical Finance, Mathematics of Operations Research, Journal of Business and Economic Statistics, Statistica Sinica, etc.

Min DAI

Professor Dai is the Director of Center of Quantitative Finance and Deputy Director of Risk Management Institute at the National University of Singapore (NUS). Before joining NUS, Professor Dai taught at Peking University. He has in-depth research in portfolio selection, trading strategies and derivatives pricing. He has published in numerous journals including Journal of Economic Dynamics & Control, Journal of Economic Theory, Management Science, Mathematical Finance, Mathematics of Operations Research, Review of Financial Studies, SIAM Journals. He is currently Associate Editor of SIAM Journal on Financial Mathematics, Journal of Economic Dynamics& Control, Mathematics and Financial Economics etc.

Road Map

The DUO development team works on a collaborative and agile pace. We are looking to launch the product on main-net by Q3 2018.

We will publish more detailed road map through community channels.

2018-01	Market research and idea generation (done)
2018-02	Theoretical verification, white paper preparation (done)
2018-03	White paper release, product design (done)
2018-04	Seed-round Sale (done)
2018-06	Private Sale, testnet deployment, code release
2018-08	Public Sale
2018-09	**Mainnet product launch**